If the cut end of a petiole of a leaf of *Nymphaea* is placed just beneath the water surface while the upper face of the leaf blade is in the air, gas of about the composition of the air continuously extrudes from the cut end of the petiole with pressures varying from 0 to 17 cm. of water, and in volumes amounting to several times that of the leaf in course of an hour. Both the pressure and rate of extrusion increase with a rise of the temperature of the leaf and with dryness of the air in contact with the upper surface of the blade, and ceases when the air over the blade is saturated or when the blade is immersed. By piercing the upper surface of the blade of *Nymphaea* just over the petiole repeatedly with a needle, turning up the margin of the blade, and supporting a little water over the punctures, a great extrusion of air can be demonstrated, increasing with the temperature of the leaf and with dryness of the air over the marginal region of the blade. This is almost identical with the main observations on *Nelumbo*, and is explained by the same physical principle. URSPRUNG believes that a considerable part of the gas exchange in leaves of water plants floating or borne above the water is brought about by "hygro-diffusion," but that it plays no considerable rôle in the gas exchange of land plants with their narrow intercellular systems, and of course no part in submerged leaves. The studies of OHNO and URSPRUNG now make possible a much more lucid statement of gas movements and pressures in the intercellular systems of plants than was formerly[20] the case.—WILLIAM CROCKER.

**Cytology of rusts.**—Investigations of the cytology of *Puccinia Falcariae* by DITTSCHLAG[21] and of *Endophyllum Sempervivi* by HOFFMANN[22] show that the sequence of nuclear phenomena in these forms agrees in its essential details with that of other rusts. Among the facts presented the following are of special interest. In *Puccinia Falcariae*, which is an autoecious form of the *Puccinopsis* type, the binucleate phase arises by the lateral fusion of the cells of a palisade-like layer differentiated near the lower middle of the young aecidium. Unlike the mode of origin of binucleate basal cells in the true aecidia of *Puccinia Poae* as described by BLACKMAN and FRASER, the mode of origin of these cells in *Puccinia Falcariae* resembles more nearly that usually observed in aecidia of the *Caeoma* type, in which the fertile cells are not overlaid with a mass of sterile tissue. Occasionally three cells fuse and thus trinucleate basal cells arise. Occasionally the basal cells branch and form more than one row of spores. Regarding the trichogyne-like cells observed by some investigators, the author states that the so-called sterile cells are not always present, but when they are they occur on both sexual cells.

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[20] PFEFFER, W., Plant physiology. Eng. ed. Vol. **1.** pp. 199. 1899.

[21] DITTSCHLAG, E., Zur Kenntnis der Kernverhältnisse von *Puccinia Falcariae*. Centralbl. Bakt. II. **28**:473–492. *pls. 3. figs. 6.* 1910.

[22] HOFFMANN, H., Zur Entwicklungsgeschichte von *Endophyllum Sempervivi*. Centralbl. Bakt. **32**:137–158. *pls. 2. figs. 14.* 1911.

The life history of *Endophyllum Sempervivi* is peculiarly interesting because in that form the aecidiospores function as teleutospores. HOFFMANN finds that the binucleate basal cells arise from fusion of cells in the lower part of the aecidium. The axis of fusion, however, may lie in any direction, and there is no palisade-like arrangement of the fusion cells. The paired nuclei of the aecidiospore fuse and the subsequent processes are like those in teleutospores. The sporophyte phase is restricted to the aecidiospore mother cell and the two cells (aecidiospore and intermediate cell) formed from it.

In both of these forms the binucleate cells arise from the fusion of fertile cells, whose contiguous walls are dissolved. In this respect the process differs from the migration of nuclei through pores as described by BLACKMAN in his account of *Phragmidium violaceum.*

In a short note BEAUVERIE[23] reports further observations on the "corpuscules métachromatiques" which he finds in the mycelium of an unidentified rust of wheat and also in the host cells. The author now identifies these bodies with the "excretion bodies" of ZACH, and believes they remain in the host cells after the hyphae themselves have been digested.—H. HASSELBRING.

**Embryo sac of Gunnera.**—Ever since the investigation of *Gunnera* (Haloragidaceae) by SCHNEGG in 1902, the genus has been included with those interesting angiosperms (as *Peperomia*) displaying an excessive number of nuclei in the embryo sac preceding fertilization. It was very desirable to study the situation more critically, and this has been done by SAMUELS[24] for *G. macrophylla.* The sequence of events is as follows: The solitary hypodermal archesporial cell (mother cell) develops directly into the embryo sac, no tetrad in the ordinary sense being formed. At the first (heterotypic) division of its nucleus the reduced number of chromosomes was repeatedly observed to be 12. At the second division (four nuclei) two nuclei assume the micropylar polar position, and the other two are against the wall of the sac in the equatorial plane, and a little later move toward the antipodal pole. The polarity of the sac is thus attained at the 4-nucleate state. At this time the inner integument fuses to close the micropyle, and therefore the pollen tube was observed to pierce the integuments to reach the sac. The numerous vacuoles that appear during the second division fuse into a large central vacuole during the development of polarity. At the third division (eight nuclei) the upper one of the two micropylar nuclei divides to two nuclei side by side; and at the fourth division (16 nuclei) each of these two nuclei divides to two nuclei vertically placed. These four micropylar nuclei are the egg, the synergids, and the micropylar

[23] BEAUVERIE, J., La signification des corpuscules métachromatiques dans les cellules de céréales infestées par la rouille. Compt. Rend. Soc. Biol. **70**: 461–463. 1911.

[24] SAMUELS, J. A., Études sur le développement du sac embryonnaire et sur la fécondation du *Gunnera macrophylla* Bl. Archiv für Zellforsch. **8**: 53–120. *pls. 3–5. figs. 23.* 1912.